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(54) **COLLAPSIBLE CONTAINER**

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Description

FIELD OF THE INVENTION

This invention relates to semi-rigid collapsible containers. The invention has particular though not exclusive relevance to containers for the storage of aerated liquids and the like.

The term "semi-rigid" container refers to a container of a material such as polyethylene terephalate (PET) which will not be deformed by or take up the shape of its contents, as is the case with a "flexible" container, although the container has some flexibility to distinguish it from a "rigid" container. The term "semi-rigid" is used in this context throughout this specification, including the claims.

BACKGROUND TO INVENTION

Aerated liquids, such as aerated beverages and the like are typically stored under pressure, in airtight containers or the like, in order to maintain the liquid in an aerated state, or at least reduce the extent to which the gas, whether carbon dioxide or other gas, escapes from the liquid.

Once the container has been opened, the gases tend to discharge from the liquid. The process of discharge can be slowed to a certain extent by resealing the container. However, after resealing, there is typically an enlarged head space available into which the gas can discharge.

It is well known that if the head space can be decreased as the beverage or other liquid volume decreases, so the extent to which gas is discharged or otherwise lost from the liquid may be reduced. To this end, a number of collapsible containers have been provided to date. Some of these collapsible containers have been of the bellows-type. Such containers possess a number of disadvantages.

Primarily, these containers do not function as pressure vessels, so they cannot be used to house soft drink prior to sale. If such a container is filled with soft drink, the internal pressure from the liquid forces the container to over expand after the cap is placed on. The container overstretches into a 'blown-out' state allowing a large headspace to develop with resulting loss of carbonation. This would occur with even mild agitation, and the container could never be expected to withstand the rigours of transportation and handling methods expected of a soft drink vessel leaving the bottling plant.

Secondly, this capacity of bellows-type containers to expand as well as collapse means that after the container base been partially collapsed and recapped, it is susceptible to re-expansion and subsequent loss of carbonation as the pressure from the liquid forces a headspace to form, particularly if the container was to be dropped or shaken in any way. This rather defeats the intended purpose.

Though some bellows-type containers possess improvements, they do not fully overcome the abovementioned problems. They must also be manufactured to relatively fine tolerances and are relatively inconvenient to use.

US Patent No. 4790361 (Jones <u>et al</u>) attempted to overcome the problem of over expansion <u>before</u> any collapse is required, after the container is filled. Unfortunately, this can never be achieved in a bellows-type container without some external clamping device to hold it in place. Such a device would have to be joined to the container, resulting in increased expense. While this container might <u>partially</u> resist expansion 'beyond full' it would still yield to the very high pressures generated from agitated soft drink.

As such expansion occurs, the intended shape of the Jones <u>et al</u> container would also be 'stretched out' of the plastic, resulting in irreparable damage to the polymer. This container would also be virtually impossible to manufacture in the current plastics of choice - polyethene terephthalate (PET). Also, due to the large surface area of such a container there would be increased expense in material costs. This container would also be susceptible to re-expansion from a collapsed state.

Jones <u>et al</u> has its corrugations defined by a plurality of ridges and grooves, each ridge preferably consisting of planar regions defined by quadrilaterals and acting as a hinge about which the collapsing can take place. US Patent No. 4492313 (Touzani) also does not function initially as a pressure vessel. It, too, cannot therefore be used to package soft drink prior to sale. Touzani does go some way in overcoming the problem of re-expansion from a partially collapsed state. The method in which Touzani achieves this introduces other problems however. The container collapses in a somewhat 'sectional' manner, and expels the contents in "jumps", which may not match the volume of headspace left. This sectional manner of collapse also results in some of the contents splashing out. Also, the operator can accidentally over compress the container after the cap has been placed on (by folding the rings down), the result of which is some overflow of the contents when the cap is next released.

In British Patent Specification GB-A-781, 103 (International Patents Trust) a container for a viscous material such as toothpaste is provided with axial corrugations along its side wall. Pressure on the base enables it to move inwardly of the wall as the wall folds, dispensing the material. In United States Patent US-A-4,865,211 (Hollingworth), Netherlands Patent NL-A-294186 (Metal Box), United States Patent US-A-4,456 134 (Cooper) and French Patents FR-A-2294297 (Normos) and FR-A-623181 (Leisse) various other collapsible containers are proposed, using a concertina or other folding wall type construction. These containers are not suitable for soft drink however. The containers of US Patent US-A-4865211 and UK Patent GB-A-781,103 are particularly unsuitable as they are more easily sub-

jected to internal pressure that would over expand them when full as a result of the corrugations and tucks they each employ.

These containers would also re-expand readily from a collapsed state, particularly as they are designed with a flexible material. UK Patent GB-A-781,103 is particularly susceptible to re-expansion. U.S. Patent US-A-4865211 does however disclose the basic structure of a semi-rigid container identified in the non-characterising part of claim 1.

Each of these containers collapses with the fold in a circular or ring shape best illustrated by Figure 8 in US Patent 4865211. Reference is specifically made in NL Patent 294186 and UK Patent 781,103 to the wall folding upon itself or to lie against the uncollapsed circular wall yet to be folded. The walls in these containers are made of a flexible material like polythene. In the case of UK Patent 781,103 the contents are not fluid but are somewhat viscous. This provides support to the container walls under collapsing forces, as the material resists movement therein. This helps the flexible walls to resist buckling under collapsing forces.

other collapsible containers have included a relatively flexible bag portion which is collapsed to reduce the available headspace. While simple bag-in-the-box collapsible containers can house a liquid like 'still' wine, they cannot house beverages under pressure, such as 'sparkling' wine. This is due to the propensity a simple bag has to re-expand after collapse if there is pressure within. Improvements to this type of collapsible container have therefore to date concentrated on requiring some separate control means such as an outer container, shell or the like to control collapse and maintain the collapsed container in the collapsed state. The external control device would add considerable cost to the container as it would always have to accompany the bag. Examples of such containers are described in the patents to Cooper and Normos referred to above.

With regard to the bases of PET and other plastics containers, various proposals have been made as to possible designs, one of the most popular at the present time being the "petaloid" base of New Zealand Patent 227274 (Continental Pet Technologies, Inc).

It is an object of at least one embodiment of this invention to come some way in providing a semi-rigid container which is able to provide a progressive folding as required to reduce its internal volume and resist subsequent re-expansion.

Other objects of this invention will become apparent from the following description.

SUMMARY OF THE INVENTION

According to one aspect of this invention there is provided a semi-rigid container according to claim 1, which will not be deformed by, or take up the shape of, its contents but has some flexibility, said container having its longitudinal axis extending from a neck portion to a base portion with an intermediate folding portion in a side wall wherein said folding portion is semi-rigid having a plurality of panel means each having a profile which projects away from the main circumferential plane of the side wall at least in a direction transverse to the longitudinal axis of said container to provide rigidity against a longitudinally directed collapsing force, said panel means being flexible against a transversely directed force, said panel means being so disposed in the side wall that said folding portion under said longitudinally directed collapsing force can progressively fold relative to a remaining portion of said container into a collapsed state where the base and neck portions are positioned closer together in reducing the internal volume of said container with the panel means acting together to resist expansion of said folding portion from the collapsed state and wherein the folding portion includes a control portion which controls the folding and an initiator portion at which folding will commence.

Further aspects of this invention will become apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described by way of example and with reference to the accompanying drawings in which:

Figure 1 is a schematic side-view of an exemplary embodiment of this invention;

Figure 2 is a schematic sectional view of the embodiment in Figure 1 in a partially collapsed condition;

Figure 3 is a schematic sectional view of the embodiment in Figure 1 in a fully collapsed condition;

Figure 4 is a schematic sectional view through line XX in Figure 1.

Figure 5 is a detail of a fold in another exemplary embodiment of the invention;

Figure 6 is a schematic side view of a further exemplary embodiment of this invention;

Figure 7 is a schematic side view of still another exemplary embodiment of this invention;

Figure 8 is a schematic front view of a panel according to this invention;

Figure 9 is a schematic rearward perspective view of the panel in Figure 8;

Figure 10 is a schematic side view of the panel in Figures 8 and 9;

Figure 11 is a schematic side view of an exemplary control portion of this invention;

Figure 12 is a cross-section through JJ in Figure 11;

Figure 13 is a cross-section through II in Figure 11;

Figure 14 is a schematic side view of a container according to another possible embodiment of the invention;

Figures 15a, b, c show a still further embodiment of the invention in its original, partially collapsed and

fully collapsed positions;

Figure 16 shows very diagrammatically a still further embodiment of the invention;

Figure 17 & 18 show very diagrammatically possible embodiments of a base for containers of the present invention;

Figures 19a and 19b show possible alternative panel arrangements for further embodiments of the invention; and

Figures 20a, b, c illustrate very diagrammatically the effect of inverting or everting a cylindrical container.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The exemplary embodiments shown in the drawings, and the following description in relation to those drawings, are provided by way of example only and are not intended to be restrictive of the possible embodiments of the invention.

In Figure 1, an exemplary semi-rigid container 1 can be seen. Container 1 is a substantially elongate soft drink bottle. It has an opening 2 at one end and is provided with thread 3 to facilitate resealing using a threaded cap (not shown). Container 1 is in this example formed in polyethylene terephthalate (PET), though any suitable material may be used to provide the characteristics of semi-rigidity.

Sidewall 4 of container 1 is provided with a folding portion 5. In this example, the folding portion is defined between dotted lines A and B.

As will be seen with reference also to Figures 2 and 3, in response to a collapsing force directed longitudinally and relatively inwardly of container 1, in this example directed along longitudinal axis 8 in direction 9, container 1 progressively folds the folding portion 5 of the sidewall 4 such that as the size of the outwardly open recess 10 increases, the internal volume of container 1 will decrease.

As the folding action continues, so folding portion 5 will move relatively down the container 1 to position in receiving portion 12, which in this example is provided by girth portion 13 and base 14.

Turning now to consider the folding action in more detail, reference is once more made to Figure 1. Folding portion 5 in this example includes an initiator portion 6 and control portion 7.

Initiator portion 6 in this example is formed to include alternate areas of strength and weakness, and is relatively more susceptible to collapsing in response to forces in direction 9 than the adjacent control portion 7 and neck portion 11. Thus, in response to a collapsing force in direction 9, a relatively controlled movement of initiator portion 6 will occur to initiate the folding action described earlier.

In this example of the invention, the alternate areas of strength and weakness in initiator portion 6 are provided by two adjacent, transversely arranged annular segments of the sidewall. The lines of weakness are defined at the interstices of the adjacent annular segments. Rather than any decrease in thickness of material by scouring or the like, the lines of weakness may be just changes in angle within the portion 6.

The control portion 7 in this example is provided with a plurality of substantially elongate polygonal panels 112 each having four sides to form a diamond shape. The panels 112 are each positioned so that they point along the longitudinal axis of the container and are positioned adjacent one another so as to provide the sidewall 4 with a substantially frustoconic shape.

The substantially frustoconic shape assists the folding portion 5 of sidewall 4 to position itself within receiving portion 12 as now explained. However, other shapes such as cylinders and polygons could be used for the folding portion 5 provided they utilise panel means such as 112. Such shapes would however affect the space into which the folding portion 5 was able to move in folding, and alter the ease with which the folding was formed. Referring particularly to Figures 2 and 3, apart from the lip 100 formed at the periphery of the recess 10 formed as the fold is created and rolled over and down the container, the diameter of the folded portions of folding portion 5 is less than the diameter of the portions remaining to be folded. Because of this, there is room for the folded portions to position in receiving portion 12 after folding.

Reference to Figure 20 will further illustrate this point. If the sidewall 500 of a container is essentially cylindrical in shape as shown, rather than frustoconical, then attempting to fold the container in this way would result in the inverted ring formed from the top wall 499, having a diameter H (Figure 20b), which would have to be less than its diameter G (Figure 20a). This would result in axial stresses that would resist inversion. There would be no room within the cylinder into which the wall 500 could be folded, while retaining the original diameter G. There would be a corresponding transfer of force down the sidewall, in direction L, instead of into a fold and this would result in the cylinder wall 500 buckling, as shown at 501 in Figure 20b, under a collapsing force in the direction P instead of inverting. The only way to make a cylinder behave in such a way, in fact, would be to hold it in an external frame or mould and invert it forcibly via a plunging device, which would thrust it into itself. The inverted segment would still buckle considerably due to its insistence on taking a reduced diameter (a circumference of given length must deform in order to reduce in diameter, at any point).

Alternatively, it must break or stretch as shown at 498 in order to increase in diameter, if everted for example (see Figure 20c), but similarly an external device would have to be employed to influence such behaviour.

Therefore, in order to have a container that collapses only, with a force being directed longitudinally on it, and without employing the aid of an external device, the

collapsing segment must, in the absence of the panels of the present invention, be frustoconical in shape, or the material must be somewhat elastic and capable of expansion or contraction - as it cannot retain the original dimensions in the new position.

Without such an initiator portion such as 6 in Figure 1, even a frustoconical section could prove difficult to be collapsed by controlled inversion, particularly one of steep attitude and reasonable sidewall length. The sidewalls would not be able to withstand the forces of the top load and the container would simply deform and collapse completely at random. The force needed to start inversion at any point on the steep walls would be much greater than that required to deform and buckle the walls. Once part of the wall begins buckling the rest of the container continues this buckling pattern in response to further downward pressure.

Referring once again to Figures 1, 2 and 3, as may be appreciated, an operator applying a collapsing force in direction 9 will in practice direct the collapsing force only generally in the direction of arrow 9. There will be deviations in the direction of the force applied. The deviations in the collapsing force will, if not countered or otherwise diminished, result in irregular folding and rolling of the folding portion 5, particularly if collapsed too quickly. Irregular folding will in turn lead to a jamming and buckling of the sidewall 4 rather than the progressive folding action it is desired should occur in response to the collapsing forces.

The panels 112 of folding portion 5 are provided to enable folding of the container to occur in a predetermined and relatively regular manner.

The panels 112 of control portion 7 assist regular folding and reduce the tendency for the side wall to jam and buckle in response to collapsing forces. The way in which this occurs will be more readily understood by reference to Figures 4 and 5.

The panels 112 of the control portion 7 are shown shaped to be substantially arcuate, as viewed on end section. An indication of this arcuate shape can be seen with reference to Figure 4 which is illustrative of a cross-section along the line X-X of Figure 1. Providing the panels with an arcuate shape, such as that shown with reference to panel 112 in Figure 4, enhances the control exerted by the panels 112 during folding.

In the orientation shown in Figure 4, panel 112 has yet to be folded. The panel 112 is separated from adjacent panels by barrier means 90 and 101, provided in this example as relatively narrow non-arcuate portions of the sidewall 4, forming the frustoconical substrate network 111 of Figure 1. The chord formed between the barrier means 90 and 101 is represented by dotted line 23.

As the container is collapsed and the sidewall 4 progressively folds inwards, so panel 112 will deform (by straightening) to lose its arcuate shape. As viewed in the drawings, the shape will be chordal. That is, substantially similar to the shape of chord 23.

Because the length of the arc of panel 112 (the arcuate length of panel 112) is greater than the length of the chord 23 (the chordal length 23), folding will cause a slight expansion in the periphery of the recess formed during the folding action. The chordal length between barrier means 90 and 101 at each side of panel 112 will increase to a maximum equal to the arcuate length of panel 112. Thereafter, as folding continues, a portion of the panel 112 having been folded will typically return to the substantially arcuate shape it adopted prior to straightening and folding.

The expansion of the periphery can be seen by reference to Figure 5 which shows how the periphery of the recess being formed by sidewall 4 at its lip 100, bends out from its normal position substantially in line with the outside of the container, shown by line 24, as the fold 26 progresses down the sidewall.

Enabling the periphery to expand slightly allows a frustocone to invert with relative ease. Force is transferred radially to increase the periphery of the sidewall and is not transferred down the sidewall which could otherwise lead to buckling of the sidewall. This expansion of the periphery of the sidewall allows room for sections of the frustoconical sidewall to roll over into inversion and take their place inside the sidewall yet to folded. This accommodating feature of a frustoconical section with such panels 112 offers much less resistance to the waveform created by the periphery 100 of the recess 10 as it travels down the sidewall, as illustrated in Figure 5.

Further, by dividing the sidewall 4 of the container into the adjacent panels 112 of this invention, the side wall 4 is divided into, and folds in portions of, predetermined chordal length. The periphery of the fold therefore forms into a polygonal shape, as defined by joining the chords formed during folding (see Figure 4). The polygon formed will have a variable number of sides, depending on the number of panels employed and the amount of arc contained therein. Therefore, the periphery of the folding section (100 in Figure 2) will not be circular as found in prior art proposals such as referred to above. This polygon formation helps direct the folded sections toward each other and to crimp together causing a latching effect to take place which is then further enhanced by the formation of the arcuate panels again once they have rolled over the chord and onto the other side. This latching effect prevents the folded portion from returning to the unfolded position, even under high internal pressure. The corners of the polygon formation are relatively close to the unfolded wall portion. In the case of the arcuate panels 112, the chordal length during folding will range between the length of the chord, as measured between the sides of the arc prior to folding, and the arcuate length of the panel 112, see Figure 4.

By controlling the chordal length of the sidewall portions being folded, so the tendency for jamming and buckling to occur during folding is decreased. The panels 112 exert an evening effect on the fold 100 as it moves down the container, and this tends to correct any

wrong deviation in the direction of collapse that is applied by an operator.

The diamond-shaped, arcuate panels 112 shown in this example of the invention assist and control the folding action of the control portion 7.

The barrier network 90, 101 that runs between the diamond-shaped arcs of the panels 112, forming the interconnecting substrate 111, provides the control portion 7 with the strength to resist any expansion when under biaxial pressure. When the container 4 is used for storage of aerated beverage and the like, simple elongate panels on the control portion, such as have been proposed for containers in the past, would allow the container walls to be flexible and therefore expand when under pressure from the contents. This would allow a headspace to build with resultant loss of carbonation.

The barrier network 90, 101 within the diamond panels 112 is tensed in both directions when the cap is placed on and internal pressure builds. The barrier network 90, 101 rests on a purely frustoconical base or substrate 111. It is mentioned that the shape, size and/or depth of this interconnecting network or substrate 111 between the panels can be varied as required to suit the desired characteristics of the resultant container. Such force attempts to cause movement in both directions on the diamond panels 112. Because the force in each direction is equal the diamond shape cannot alter. Because each panel 112 is a fixed size the control portion 7 cannot expand.

Once the cap is removed, however, there is no force in either direction. It is while the cap is off that an operator may, by choice, apply pressure in one direction, 9 in Figure 1, (downwards to collapse the container). Because force is directed in one direction only, the diamond shape of the panels 112 can be forced to relax in the vertical and allow the arcuate panels 112 to begin influencing the periphery by donating otherwise redundant material. Thus peripheral expansion of the fold 100 is achieved and so is control of collapse in the manner already described.

The panels 112 also exert another major influence over the behaviour of the container 1 used as a collapsible container for liquids under pressure. The inverted section of the control portion is further prevented from being forced to revert to its original position. The folded over diamond arcs of the panels 112 re-expand once in the inverted position and tend to 'jam up' if force is applied to expand the container 4 from the collapsed state. This could be caused by a build-up of pressure within the contents if the container 4 was dropped, for example. The inverted section cannot fold back out, but tends to be held in place by the arcs that have been folded over. This enables the container to retain its integrity as a pressure vessel, even in a partially collapsed state.

In practice, polygons with a varying number of sides could be employed on the folding portion. They could be mixed shapes even though there would be no distinct advantage over the diamond network. However, polygons of increased or decreased number of sides could be employed with differing arrangements of arcing. other geometric shapes could also be employed without departing from the scope of the invention.

The amount of arcing applied within the panels could also be varied according to the amount of control desired over the chord formation which affects ease of collapse. While arcing in the transverse or hoop direction is an essential requirement, arcing in the longitudinal direction may in most instances also be provided.

Thus referring to Figure 19a, a folding section 600 of a container according to one possible embodiment is defined by a plurality of triangular panels 601, arced so that the panels peak at their centres. In Figure 19b the folding section 602 of another embodiment has circular panels 603, again arced so as to peak at their centres.

Returning now to Figures 1, 2 and 3, it will be seen that base 14 is formed to provide a hollow 28. The hollow 28 is formed relative to those portions of neck 11 adjacent the folding portion 5 such that when container 1 is substantially fully collapsed and the fold 100 in the sidewall 4 is more or less at its greatest size, hollow 28 is substantially surrounded by neck portion 11.

Thus, as can be seen from Figure 3, rim 29 of neck portion 11 in this example defines an area which on plan is at least equivalent to or preferably greater than the area defined by rim 30 of hollow 28. And, in the folded position shown, portions of rim 29 are circumferentially disposed relatively outwardly of rim 30 so as to assist the flow of fluid contained in the hollow 28 into the neck portion 11 and towards opening 2, during tipping rather than into the fold in sidewall 4.

Turning now to consider Figure 6, an alternative arrangement for the folding portion can be seen. In Figure 6, folding portion 15 includes initiator portion 16 and control portion 17. The control portion 17 in this example includes hexagonal panels 22 .

The initiator portion 16 is also shown having hexagonal panels 22. The panels 22 that make up initiator portion 16 may if required be smaller and more numerous than the panels making up control portion 17 and may be offset relative to the positioning of the panels of the control portion 17.

For non-carbonated beverages and particularly for any hot-fill requirements, it may be desirable to employ a configuration that allows some contraction after filling. By altering the panel connecting barrier network configuration referred generally by 599, (111 in Figure 1), it is possible to forego the ability of the control portion to contain pressure (which would not be needed for non-carbonated beverages in exchange for an ability to contract, for example).

An example of how this could be achieved would be by removing the transverse connecting portions 598 from the barrier network and allowing the arc from each hexagonal panel 22 to communicate in a longitudinal manner. Once again many variations could be employed without departing from the scope of the inven-

tion. All formations would fold in a polygonal shape as viewed from above.

This removal or alteration of the transverse or other connecting portions between panels 22 could be utilised in any of the other embodiments of the invention described herein.

As will be appreciated, in other embodiments of this invention other suitable arrangements for initiating and controlling folding may be provided on the folding portion. For instance, in at least one other embodiment of the invention, where panels are provided, single panels can extend through the control portion and initiator portion, substantially to traverse the whole of the folding portion of the container. An example of this type of embodiment is shown in Figure 7.

Considering Figure 7, container 200 can be seen including a neck portion 201, folding portion 202 defined between lines G and H and receiving portion 203.

The area immediately adjacent the intersection of neck 201 and folding portion 202 is provided with a recess 204 to assist handling of the container 200.

Folding portion 202 is provided with an initiator portion 205 and a control portion 206. Receiving portion 203 includes girth portion 207 and base 208.

As will be seen, the folding portion 202 is provided with a plurality of diamond shaped panels 209, which will be arcuate at least in the transverse direction, each panel being aligned with the longitudinal axis of the container 202 and positioned adjacent one another to provide the folding portion 202 with a substantially frustoconic shape.

In this example of the invention, panels 199 in the neck portion 201 and in the receiving portion 203 have a different function. These panels 99 do not assist folding but instead provide strength to the neck 201 and receiving portion 203 and assist those portions to resist buckling or otherwise deforming under axially directed folding forces. There is, relative to the arc provided to the panels 209, only a relatively slight arc in neck 201 and the receiving portion 203.

Further alternative forms of this invention may employ small arcuate panels around the recess 204. These panels may assist the recess to resist any plastic creep within the material when under very high pressure, as this area is normally not as strong as the rest of the container sidewalls due to the nature of biaxial orientation in manufacture. Other methods may also be employed to assist the strength of the recess 204 without departing from the scope of the invention, for example the addition of a strong, external retaining ring made of a suitable material being placed around the recess 204.

It is a still further object of a preferred embodiment of this invention to provide an improved base section for a beverage container.

During bottle manufacture using biaxial orientation, the polymer molecular orientation is less at the top and bottom of the bottle so these areas need to be made thicker, but the common round design of the base minimises the material required (due to its better pressure containing capacity). With this rounded design the bottle cannot be stood upright, however, so a base 'cup' having a flat bottom is required. This may be injection moulded in PET or more usually high density polypropylene.

Much thought has been given, in the United States particularly, towards a base design which would obviate the need for a separate cup, and Continental Beverage Containers Inc have proposed a base having 4 or 5 extrusions which form feet on which the bottle can stand. This design, as mentioned previously, is usually referred to as a "petaloid" base and has drawbacks in that more material is required and the blow moulding machines need higher blow moulding and mould clamping pressures.

Another drawback is the many areas of differing material thickness distributed around the base. Very complex stress patterns are induced as a result of these varying thicknesses.

Another drawback is that the thick unstretched central area becomes a prime site for fracture under pressure and it is this area that is the most common site of bottom failure. This is because the intense pressure acts to "pull apart" and force outwards the surface presented. Another drawback to this sort of base design is that the container cannot stand upright with stability on a grill-like surface, as is most common in refrigeration units. This has led to resistance from both the shop-keeper and the customer.

It is an object of these embodiments of the present invention to overcome some of these problems, or at least provide a suitable option.

So referring again to Figure 7, exemplary base 208 is shaped to provide a hollow 211 substantially similar to that described earlier in relation to Figures 1, 2 and 3, to assist the collection and transmission of residual contents of the container to the opening 210. To assist the base 208 to withstand the internal pressures of typical aerated beverages, particularly where the container is formed in PET or the like, a relatively deep punt 211 is provided, the term 'punt' being that used to describe the hollow at the bottom of champagne bottles especially.

Exemplary base 208 provides an improvement over previous proposals by providing a fat, circular ring upon which the bottle rests, rather than feet (as is the case with a petaloid base). This full-contact ring allows greater stability when placed on incomplete surfaces such as the grills commonly found in refrigeration units.

Referring to Figures 8 to 13 examples of the diamond shaped panels (209) such as of Figure 7 are illustrated in greater detail. It is seen that the panels 301, 302, 303 can be provided so as to form a compositive panel 300 tapering towards one end. As the sectional and cross sectional views of Figures 9 and 10 illustrate the panels 301 to 303 are arcuate in both transverse and longitudinal directions so as to control the folding as previously described. In Figures 11 to 13, the dia-

mond panels 305 of the control portion 304 are shown to be arcuate and forming the frustoconical shape required for the folding action.

Referring now to Figure 14, a further embodiment of the invention is illustrated and referred generally by arrow 478. This is shown with the diamond panels of the previous embodiments replaced with a plurality of hexagonal panels, 475, forming the folding portion 472. The initiator portion 476 is shown provided with a plurality of concentric lines of weakness, which may just be angular changes, leading up to the neck portion 477. The base 474 again provides an internal diameter commensurate with, or less than, that of the rim of the neck portion 477. The hexagons 475 are shown aligned in the direction of the longitudinal axis of the container 478. Each panel 475 will be arcuate at least in the transverse direction so as to permit collapsing axially as a result of a collapsing force, but to resist expansion circumferentially due to internal pressure.

Referring now to Figures 15a, b, c, a further embodiment is referenced generally by arrow 492. It is seen to have a downwardly facing frustoconical folding portion 488 defined by a network of diamond shaped panels 420. This arrangement of the upward folding control section 488 allows for more complete emptying of the container as it is collapsed. No air at all can be trapped within the collapsing walls, as is common with 'upright' versions. This network of arcuate panels 420 resists the expansion forces and holds the folding portion 488 in place. The dimensions of these panels 420 can be different, of course. They could be wider on some containers than others, and even take differing sizes on a single container. When the cap is taken off, the network 488 is no longer under force from the beverage. Such force would normally attempt to cause movement in both the vertical and horizontal directions of each panel 420 of the network 488. Because the force in each direction is equal when the cap is on, the diamond-panelled network 488 cannot move. Once the cap is off, however, there is no force in either direction. It is while the cap is off that an operator may, by choice, apply pressure in one direction (downwards, as shown in Figure 15(b), to collapse the container). Because force is directed in one direction only the diamond panels 420 of the network 488 can be forced to relax in the vertical and allow the arcuate panels 420 to begin influencing the periphery 487 by donating otherwise redundant material. Thus peripheral expansion of the fold 487 is achieved as it moves over the base 490 and so controls the container collapse in the manner already described.

Still other forms of the invention according to this and the other embodiments may employ more than one folding control section.

Referring to Figure 16, the container 800 of this embodiment has a folding portion 802 with diamond shaped arcuate panels 801 forming a frustoconical shape tapering upwardly rather than downwardly as in the previous Figures 15.

Returning again to the formation of the base of the containers of the present invention, a further improvement is the more even distribution of material throughout the base. The inward presenting face, 480 of the base 483 in Figure 17, is formed to be concave rotated around a central pillar 481 of relatively unstretched material about the punt 479. By placing the unstretched material in such a shape, it becomes self supporting under pressure and is therefore more protected from fracture. Not only is it self

buttressing under pressure, but it becomes nearly impossible to force downwards 'out the bottom' of the container, as is a common failing of champagne-style punt bases made of such thin material, that employ, for example, a convex dome presenting inwards.

In alternative forms of the invention the base may be provided with arcuate panels arrange to resist the folding forces mentioned above in relation to the example of the invention in Figure 17. The addition of arcuate panels to this section increases the pressure carrying level. Just as arcuate panels can help material to fold in one direction, if they are reversed in direction the panels can inhibit any tendency to fold. By employing them near the central column 481 in Figure 17, any affinity the base has to be forced downwards and fold out under the pressure is reduced significantly.

Figure 18 shows a further exemplary base 483, employing such arcuate panels 486 about the hollow column 485 of the punt 484 to increase pressure thresholds. Further panel arrangements may be employed without departing from the scope of this invention.

Still further alternative forms of this invention may use an eversion folding movement, instead of an inversion folding process. A container according to this invention could have a folding portion with an everting initiator portion and an everting control portion. The arcuate diamond or other shaped panels in such embodiments would face inwards, not outwards.

It is seen that the present invention in its various embodiments provides a container which has different portions capable of accommodating different loadings and where the collapsing is achieved through a middle portion folding and not by an end being pushed inwardly.

Thus, it will be appreciated that by this invention there is provided an improved container wherein control of progressive folding of the sidewall of the container so as to collapse it, is assisted, and in preferred embodiments the base is also designed to carry higher pressures and afford the container increased stability.

Claims

1. A semi-rigid container (1), which will not be deformed by, or take up the shape of, its contents but has some flexibility, said container (1) having its longitudinal axis (8) extending from a neck portion (11) to a base portion (14) with an intermediate folding

portion (5) in a side wall (4) characterised in that said folding portion (5) is semi-rigid having a plurality of panel means (112) each having a profile which projects away from the main circumferential plane of the side wall (4) at least in a direction transverse to the longitudinal axis (8) of said container (1) to provide rigidity against a longitudinally directed collapsing force, said panel means (112) being flexible against a transversely directed force, said panel means (112) being so disposed in the side wall (4) adjacent one another that said folding portion (5) under said longitudinally directed collapsing force can progressively fold relative to a remaining portion of said container (1) into a collapsed state where the base and neck portions are positioned closer together in reducing the internal volume of said container (1) with the panel means (112) acting together to resist expansion of said folding portion (5) from the collapsed state and wherein the folding portion (5) includes a control portion (7) which controls the folding and an initiator portion (6) at which folding will commence.

2. A semi-rigid container as claimed in claim 1 wherein said folding portion (5) is of a substantially frustoconical shape.

3. A semi-rigid container as claimed in claim 1 or claim 2 wherein said panel means (112) project away from the main circumferential plane of the side wall (4) also in the direction of the longitudinal axis (8) of the container.

4. A semi-rigid container as claimed in claim 1 wherein each said panel means (112) is in the shape of a polygon aligned substantially parallel with the longitudinal axis (8) of the container.

5. A semi-rigid container as claimed in claim 4 wherein each panel means (112) have a diamond shape aligned with its major axis substantially parallel with the longitudinal axis (8) of the container.

6. A semi-rigid container as claimed in claim 1 wherein said folding portion (5) is positioned so as to be spaced apart from both neck (11) and base portions (14) of said container.

7. A semi-rigid container as claimed in claim 2 wherein said frustoconic shape tapers inwardly towards said neck portion (11) of said container so that under said collapsing force said neck portion (11) moves towards said base portion (14) of said container.

8. A semi-rigid container as claimed in claim 7 wherein an internal diameter (29) of said neck portion (11) is substantially equal to or greater than an internal diameter (30) of said base portion (14) so that in said collapsed condition residual contents of said base portion (14) can be caused to flow into said neck portion (11).

9. A semi-rigid container as claimed in claim 2 wherein said frustoconic shape (488) tapers inwardly towards a base portion (490) of said container so that in the collapsing of said container said base portion (490) moves inwardly of said folding portion (488) towards said neck portion of said container.

10. A semi-rigid container as claimed in claim 1 wherein said initiator portion (6) contains at least a first zone which is substantially less perpendicular, with respect to said transverse direction, than any other zone in the folding portion (5).

11. A semi-rigid container as claimed in claim 10 wherein said panel means (112) are provided in said initiator portion (6).

12. A semi-rigid container as claimed in claim 5 wherein said diamond shape is provided by a pair of triangular panel means (601) positioned together.

13. A semi-rigid container as claimed in claim 1 wherein said panel means (603) have a substantially circular shape.

14. A semi-rigid container as claimed in claim 1 including a base portion (208) having a hollow substantially deep central portion (211) and a circular portion thereabout providing a stable support surface for the container.

15. A semi-rigid container as claimed in claim 14 wherein said deep hollow portion (484) includes a plurality of arcuate panels (486) thereabout to inhibit the folding of material of said base portion in response to internal pressure developed within said container.

Patentansprüche

1. Zusammenlegbarer Behälter (1), welcher trotz vorhandener Flexibilität durch seinen Inhalt weder deformiert wird noch dessen Form annimmt, weist eine Längsachse (8) auf, die von einem Halsbereich (11) zu einem Basisbereich (14) mit einem dazwischenliegenden Faltbereich (5) in einer Seitenwand (4) verläuft, dadurch gekennzeichnet, daß der Faltbereich (5) halbstarr ist und eine Vielzahl von Plattenelementen (112) aufweist, welche jede ein von der Hauptumfangsebene der Seitenwand (4) wenigstens in einer quer zur Längsachse (8) des Containers (1) liegenden Richtung vorstehendes Profil aufweisen, um Steifheit gegen eine längsgerichtete

Knickkraft bereitzustellen, wobei die Plattenelemente (112) flexibel gegen eine quergerichtete Kraft sind und derart in der Seitenwand (4) zueinander benachbart angeordnet sind, daß der Faltbereich (5) unter der in Längsrichtung wirkenden Knickkraft fortschreitend in bezug auf einen verbleibenden Bereich des Containers (1) in einen gefalteten Zustand faltbar ist, in welchem der Basis- und der Halsbereich unter Verringerung des inneren Volumens des Containers (1) enger zueinander beabstandet sind, wobei die Plattenelemente (112) zusammenwirken, um einer Ausdehnung des Faltbereiches (5) vom zusammengefalteten Zustand entgegenzuwirken, und wobei der Faltbereich (5) einen Steuerbereich (7) umfaßt, welcher das Falten steuert, und einen Initiatorbereich (6), an welchem die Faltung eingeleitet wird.

2. Zusammenlegbarer Container nach Anspruch 1, dadurch gekennzeichnet, daß der Faltbereich (5) im wesentlichen kegelstumpfförmig ist.

3. Zusammenlegbarer Container nach einem der Ansprüche 1 oder 2, dadurch gekennzeichnet, daß die Plattenelemente (112) von der Hauptumfangsebene der Seitenwand (4) auch in Richtung der Längsachse (8) des Behälters vorstehen.

4. Zusammenlegbarer Container nach Anspruch 1, dadurch gekennzeichnet, daß jedes der Plattenelemente (112) polygonförmig und im wesentlichen parallel zur Längsachse (8) des Behälter ausgerichtet ist.

5. Zusammenlegbarer Container nach Anspruch 4, dadurch gekennzeichnet, daß jedes der Plattenelemente (112) diamantförmig und mit seiner Hauptachse im wesentlichen parallel zur Längsachse (8) des Behälters ausgerichtet ist.

6. Zusammenlegbarer Container nach Anspruch 1, dadurch gekennzeichnet, daß der Faltbereich (5) sowohl vom Halsbereich (11) als auch vom Basisbereich (14) des Behälters beabstandet angeordnet ist.

7. Zusammenlegbarer Container nach Anspruch 2, dadurch gekennzeichnet, daß die Kegelstumpfform in Richtung des Halsbereiches (11) des Behälters verjüngt ist, so daß der Halsbereich (11) unter einer Knickkraft in Richtung des Basisbereiches (14) des Behälters bewegt wird.

8. Zusammenlegbarer Container nach Anspruch 7, dadurch gekennzeichnet, daß ein innerer Durchmesser (29) des Halsbereiches (11) im wesentlichen gleich oder größer ist als ein innerer Durchmesser (30) des Basisbereiches (14), so daß in dem zusammengeklappten Zustand ein verbleibender Rest im Basisbereich (14) in den Halsbereich (11) ausfließen kann.

9. Zusammenlegbarer Container nach Anspruch 2, dadurch gekennzeichnet, daß die Kegelstumpfform (488) in Richtung des Basisbereiches (490) des Behälters verjüngt ist, so daß der Basisbereich (490) ins Innere des Faltbereiches (488) in Richtung des Halsbereiches des Containers beim Zusammenlegen bewegt wird.

10. Zusammenlegbarer Container nach Anspruch 1, dadurch gekennzeichnet, daß der Initiatorbereich (6) wenigstens eine erste Zone umfaßt, die im Hinblick auf die Querrichtung weniger rechtwinklig angeordnet ist als jede andere Zone im Faltbereich (5).

11. Zusammenlegbarer Container nach Anspruch 10, dadurch gekennzeichnet, daß die Plattenelemente (112) in dem Initiatorbereich (6) angeordnet sind.

12. Zusammenlegbarer Container nach Anspruch 5, dadurch gekennzeichnet, daß die Diamantform durch ein Paar von dreieckigen und zusammen positionierten Plattenelementen (601) gebildet ist.

13. Zusammenlegbarer Container nach Anspruch 1, dadurch gekennzeichnet, daß die Plattenelemente (603) eine im wesentlichen runde Form aufweisen.

14. Zusammenlegbarer Container nach Anspruch 1, dadurch gekennzeichnet, daß dieser einen Basisbereich (208) mit einem hohlen und im wesentlichen tiefen Zentralbereich (211) und einen um diesen herumliegenden ringförmigen Bereich aufweist, welcher eine stabile Lageroberfläche für den Behälter bildet.

15. Zusammenlegbarer Container nach Anspruch 14, dadurch gekennzeichnet, daß der tiefe Hohlbereich (484) eine Vielzahl von diesen herum angeordneten Bogenplatten (486) aufweist, um ein Falten des Materials des Basisbereiches aufgrund eines im Inneren des Behälters entwickelten Druckes zu verhindern.

Revendications

1. Récipient semi-rigide (1) qui n'est pas déformé par son contenu ou ne prend pas la configuration de son contenu mais possède une certaine flexibilité, le récipient (1) ayant son axe longitudinal (8) disposé d'une partie de goulot (11) à une partie de base (14) avec une partie intermédiaire (5) de pliage dans une paroi latérale (4), caractérisé en ce que

la partie de pliage (5) est semi-rigide et possède plusieurs panneaux (112) ayant chacun un profil tel qu'il dépasse du plan circonférentiel principal de la paroi latérale (4) au moins en direction transversale à l'axe longitudinal (8) du récipient (1) en donnant de la rigidité contre une force d'écrasement dirigée longitudinalement, les panneaux (112) étant flexibles sous l'action d'une force appliquée transversalement, les panneaux (112) étant disposés dans la paroi latérale (4) les uns près des autres de manière que la partie de pliage (5), lorsqu'elle est soumise à une force d'écrasement dirigée longitudinalement, puisse se plier progressivement par rapport à une partie restante du récipient (1) à un état écrasé dans lequel les parties de base et de goulot sont plus proches mutuellement avec réduction du volume interne du récipient (1), les panneaux (112) agissant en coopération de manière qu'ils résistent à la dilatation de la partie de pliage (5) depuis l'état écrasé, et la partie de pliage (5) comprend une partie (7) de commande du pliage et une partie (6) d'amorçage à laquelle commence le pliage.

2. Récipient semi-rigide selon la revendication 1, dans lequel la partie de pliage (5) a une forme pratiquement tronconique.

3. Récipient semi-rigide selon la revendication 1 ou 2, dans lequel les panneaux (112) s'écartent du plan circonférentiel principal de la paroi latérale (4) aussi en direction de l'axe longitudinal (8) du récipient.

4. Récipient semi-rigide selon la revendication 1, dans lequel chacun des panneaux (112) a la forme d'un polygone pratiquement aligné parallèlement à l'axe longitudinal (8) du récipient.

5. Récipient semi-rigide selon la revendication 4, dans lequel chaque panneau (112) a une forme de losange aligné de manière que son grand axe soit pratiquement parallèle à l'axe longitudinal (8) du récipient.

6. Récipient semi-rigide selon la revendication 1, dans lequel la partie de pliage (5) est disposée afin qu'elle soit distante à la fois des parties de goulot (11) et de base (14) du récipient.

7. Récipient semi-rigide selon la revendication 2, dans lequel la forme tronconique a une dimension qui diminue vers l'intérieur vers la partie de goulot (11) du récipient de manière que, sous l'action de la force d'écrasement, la partie de goulot (11) se déplace vers la partie de base (14) du récipient.

8. Récipient semi-rigide selon la revendication 7, dans lequel le diamètre interne (29) de la partie de goulot (11) est pratiquement égal ou supérieur au diamètre interne (30) de la partie de base (14) de manière que, à l'état écrasé, le contenu résiduel de la partie de base (14) puisse s'écouler dans la partie de goulot (11).

9. Récipient semi-rigide selon la revendication 2, dans lequel la configuration tronconique (488) a une dimension qui diminue progressivement vers l'intérieur vers une partie de base (490) du récipient de manière que, lors de l'écrasement du récipient, la partie de base (490) se déplace vers l'intérieur de la partie de pliage (488) vers la partie de goulot du récipient.

10. Récipient semi-rigide selon la revendication 1, dans lequel la partie d'amorçage (6) comporte au moins une première zone qui est nettement moins perpendiculaire à la direction transversale que toute autre zone de la partie de pliage (5).

11. Récipient semi-rigide selon la revendication 10, dans lequel les panneaux (112) sont disposés dans la partie d'amorçage (6).

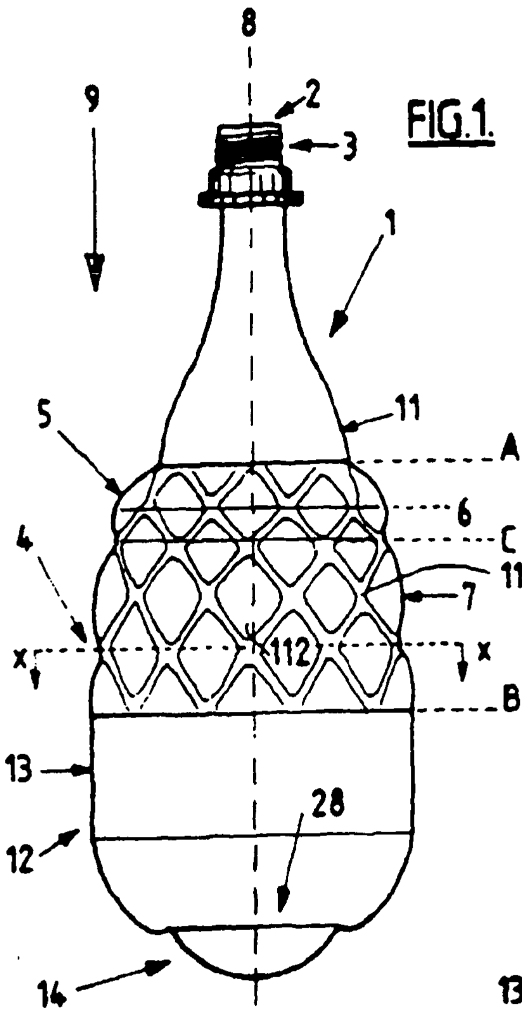
12. Récipient semi-rigide selon la revendication 5, dans lequel la forme de losange est obtenue à l'aide d'une paire de panneaux triangulaires (601) adjacents.

13. Récipient semi-rigide selon la revendication 1, dans lequel les panneaux (603) ont une forme pratiquement circulaire.

14. Récipient semi-rigide selon la revendication 1, comprenant une partie de base (208) ayant une partie centrale creuse relativement profonde (211) et une partie circulaire qui l'entoure et formant une surface stable de support du récipient.

15. Récipient semi-rigide selon la revendication 14, dans lequel la partie creuse et profonde (484) possède plusieurs panneaux courbes (486) à sa circonférence, destinés à empêcher le pliage de la matière de la partie de base sous l'action de la pression interne créée à l'intérieur du récipient.

FIG.1.



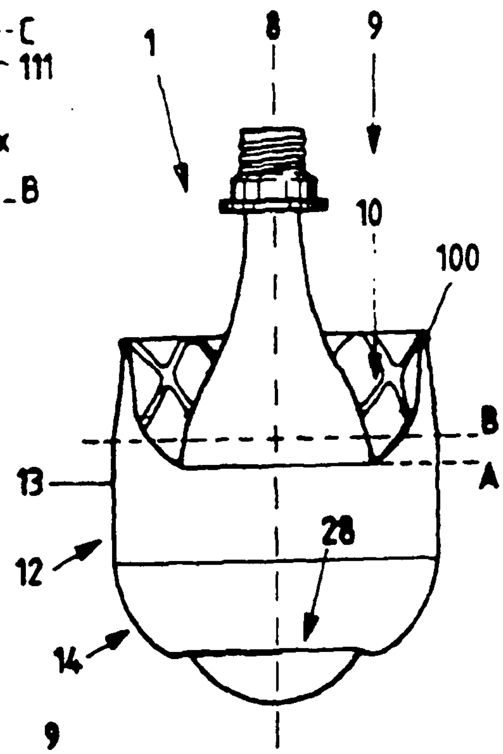
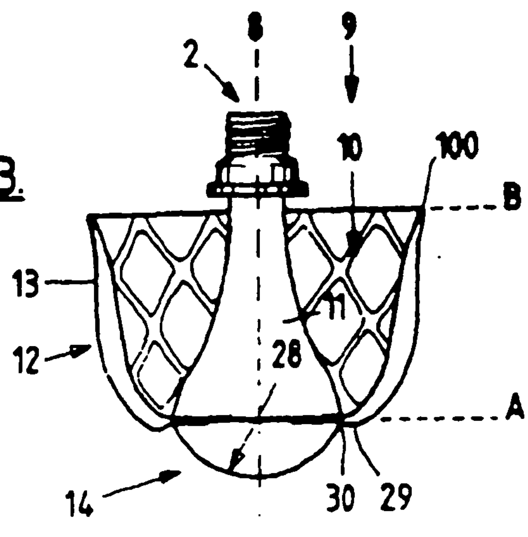


FIG.2.

FIG.3.



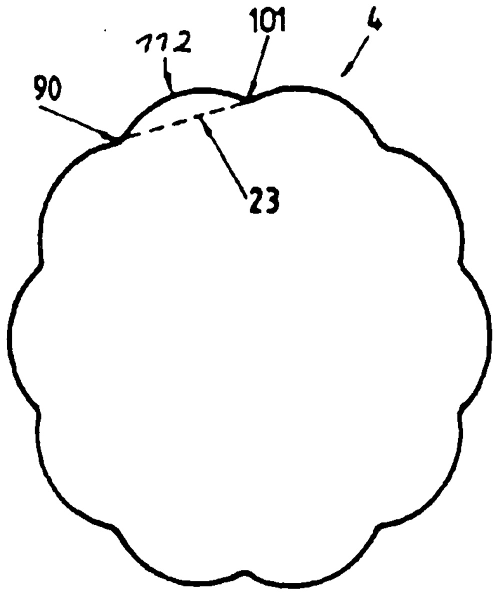


FIG. 4

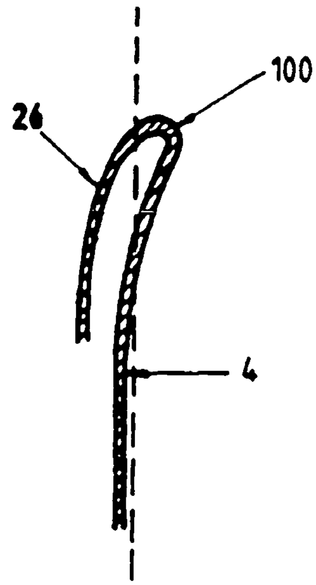


FIG. 5

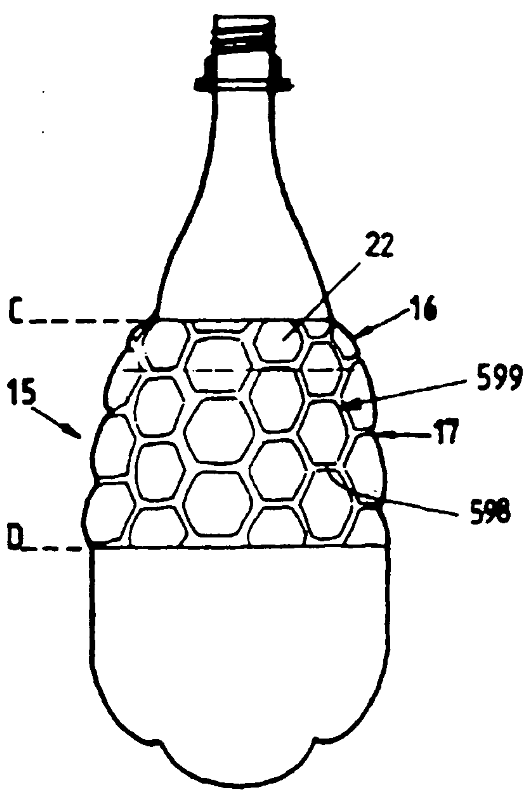


FIG. 6

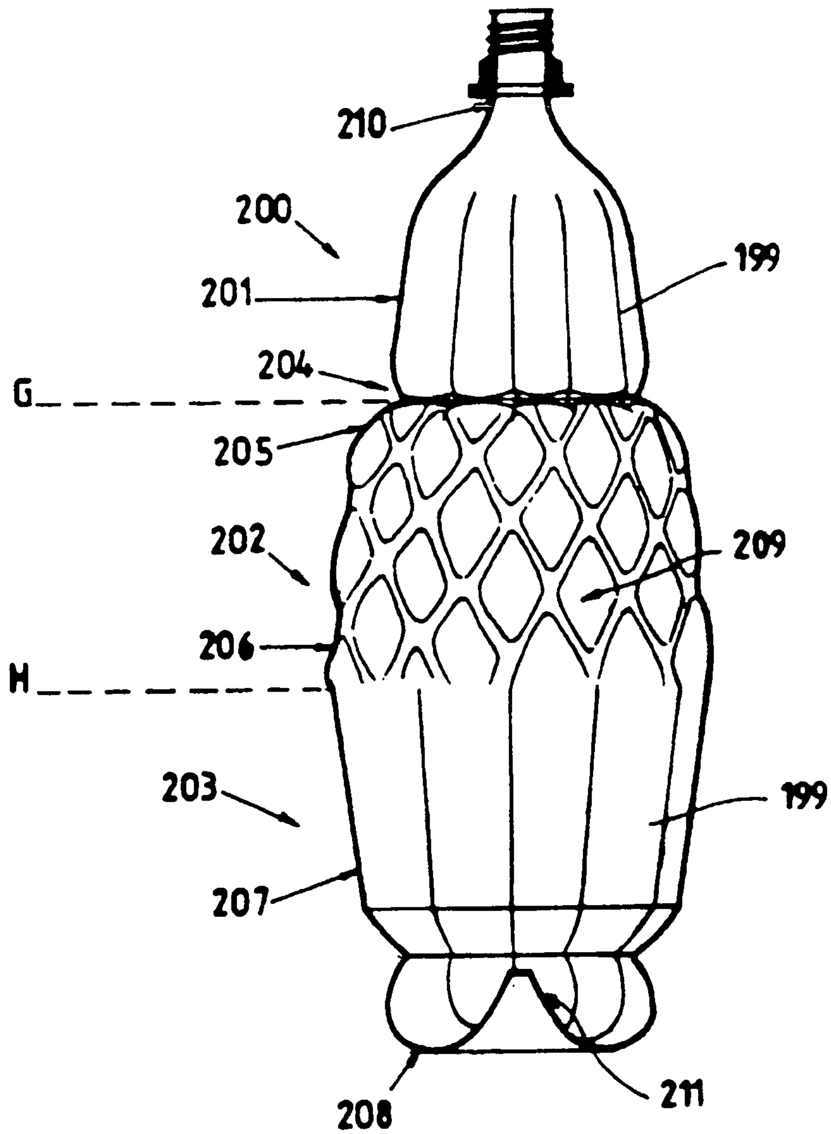


FIG 7.

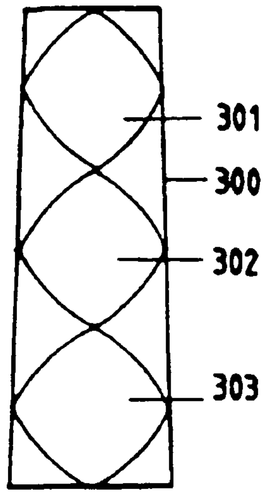


FIG.8.

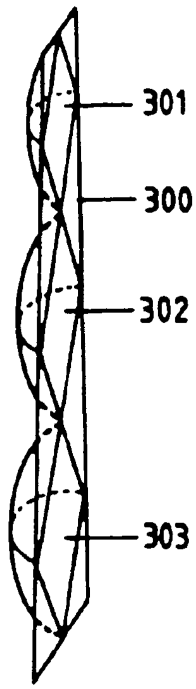


FIG.9.

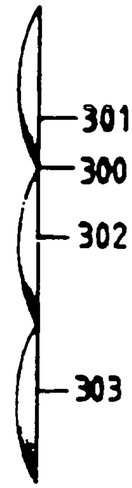


FIG.10.

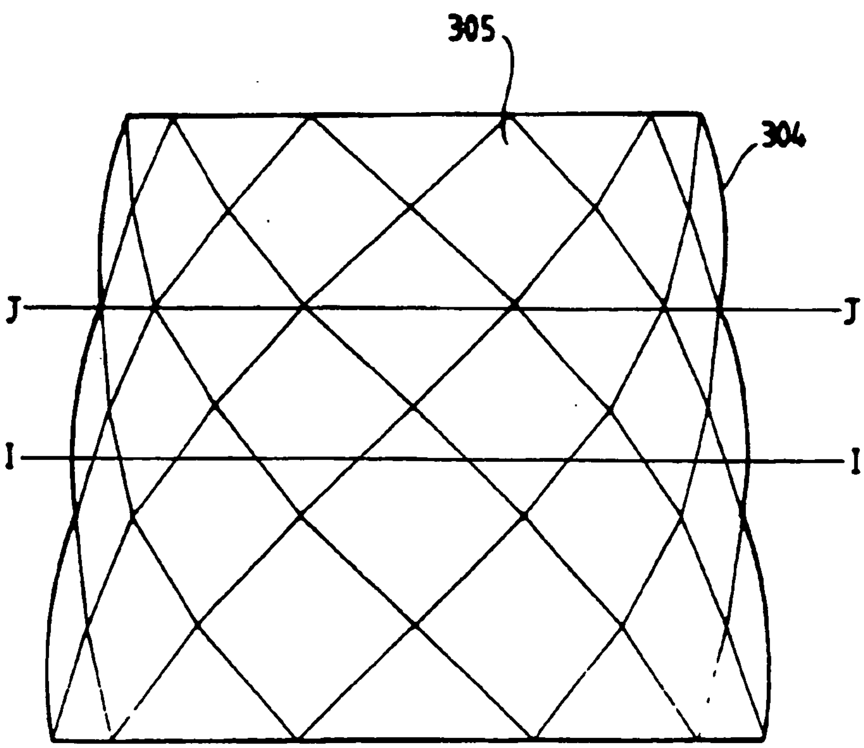


FIG.11.

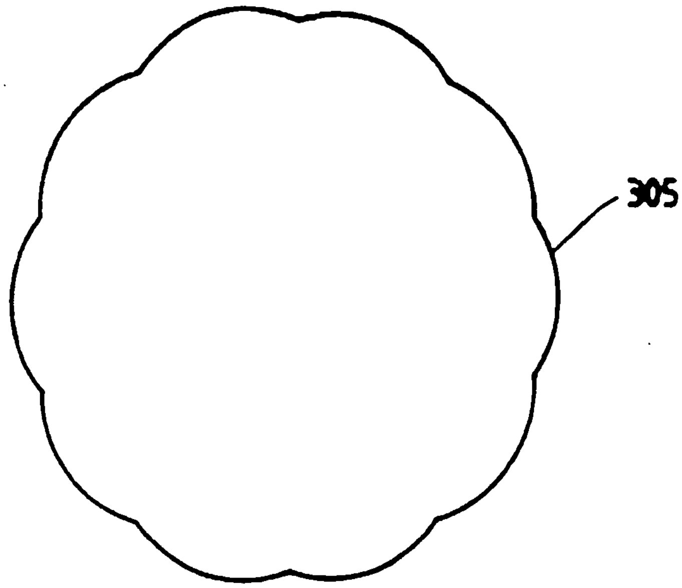


FIG.12.

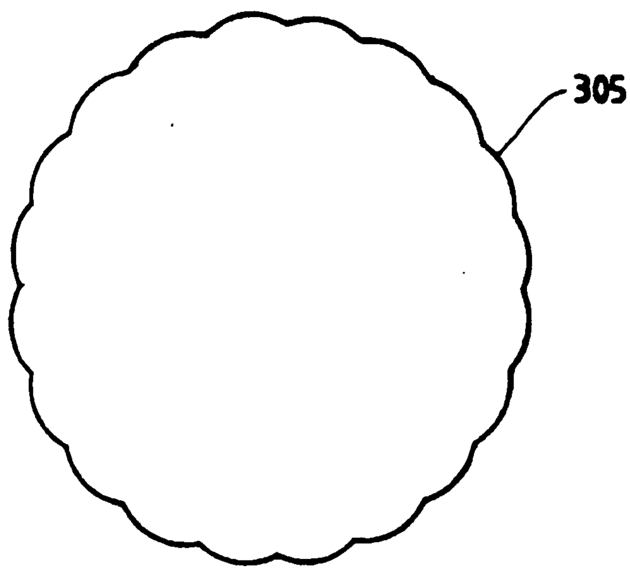
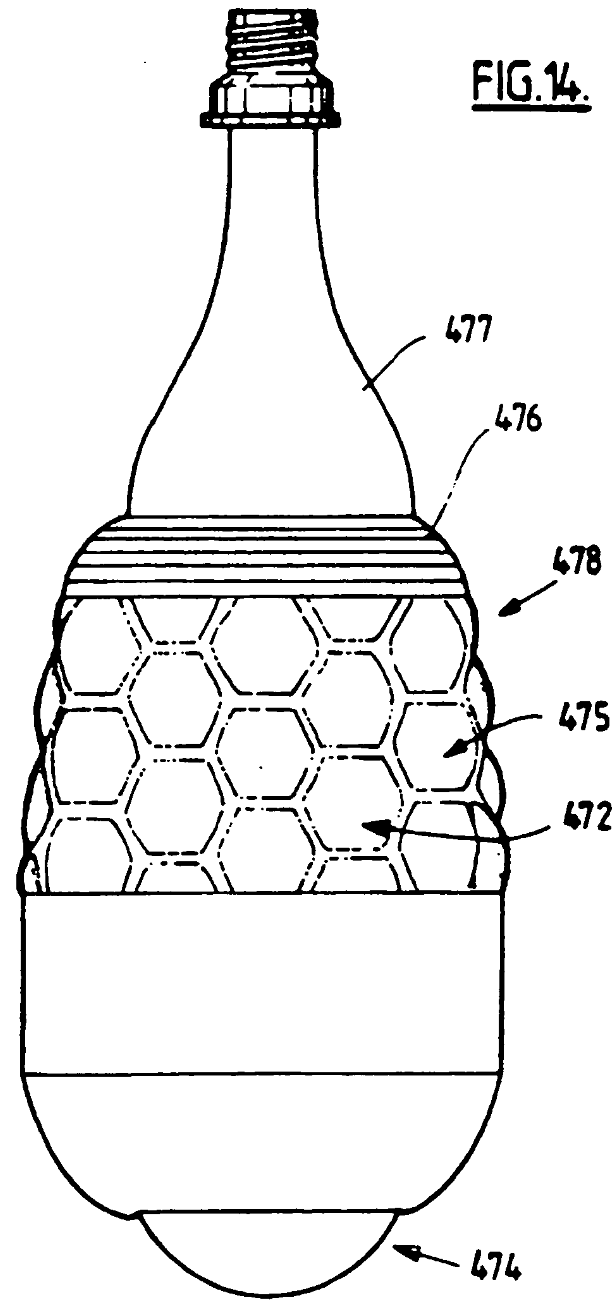


FIG.13.

FIG.14.



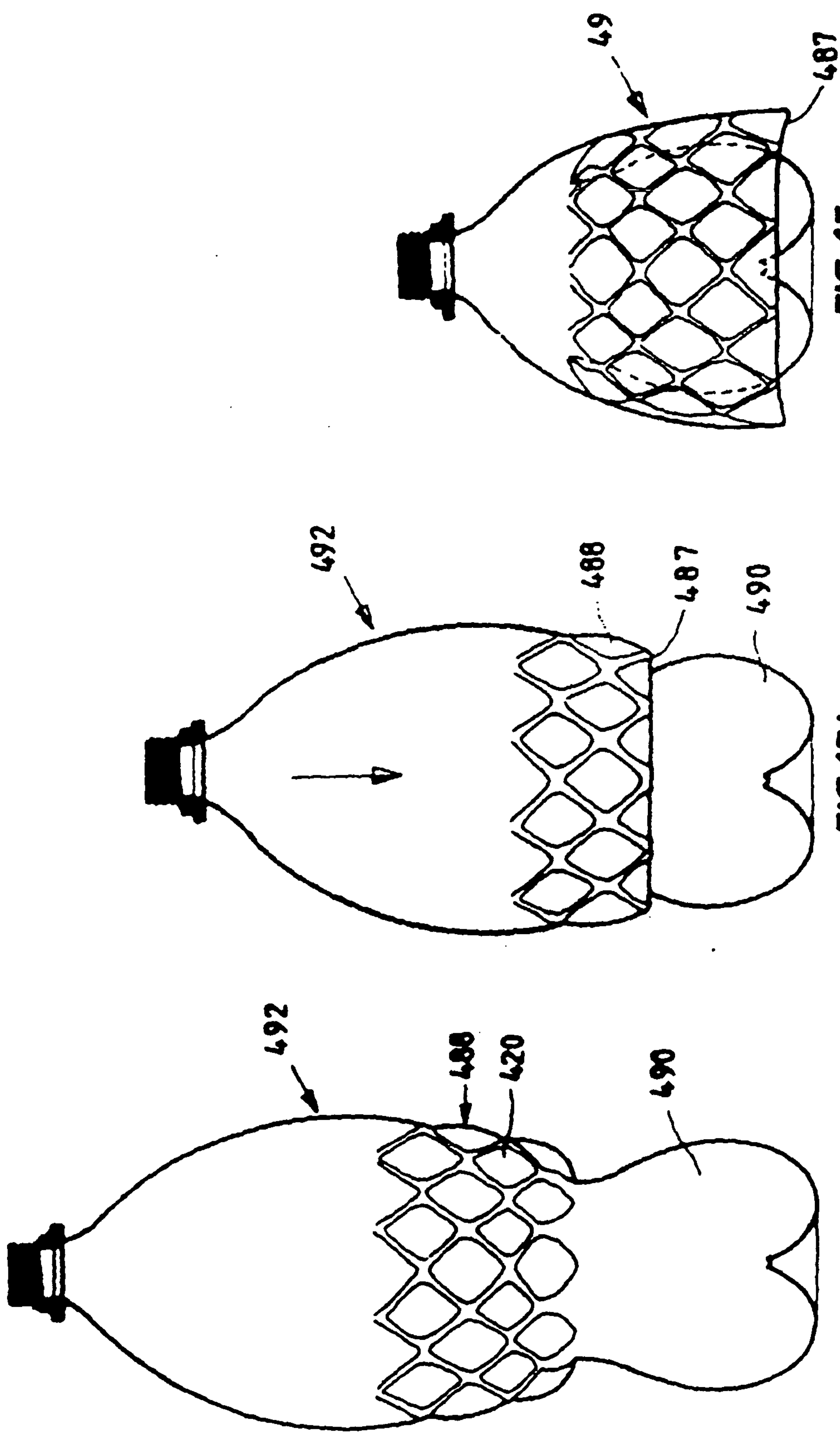


FIG.15c.

FIG.15b.

FIG.15a.

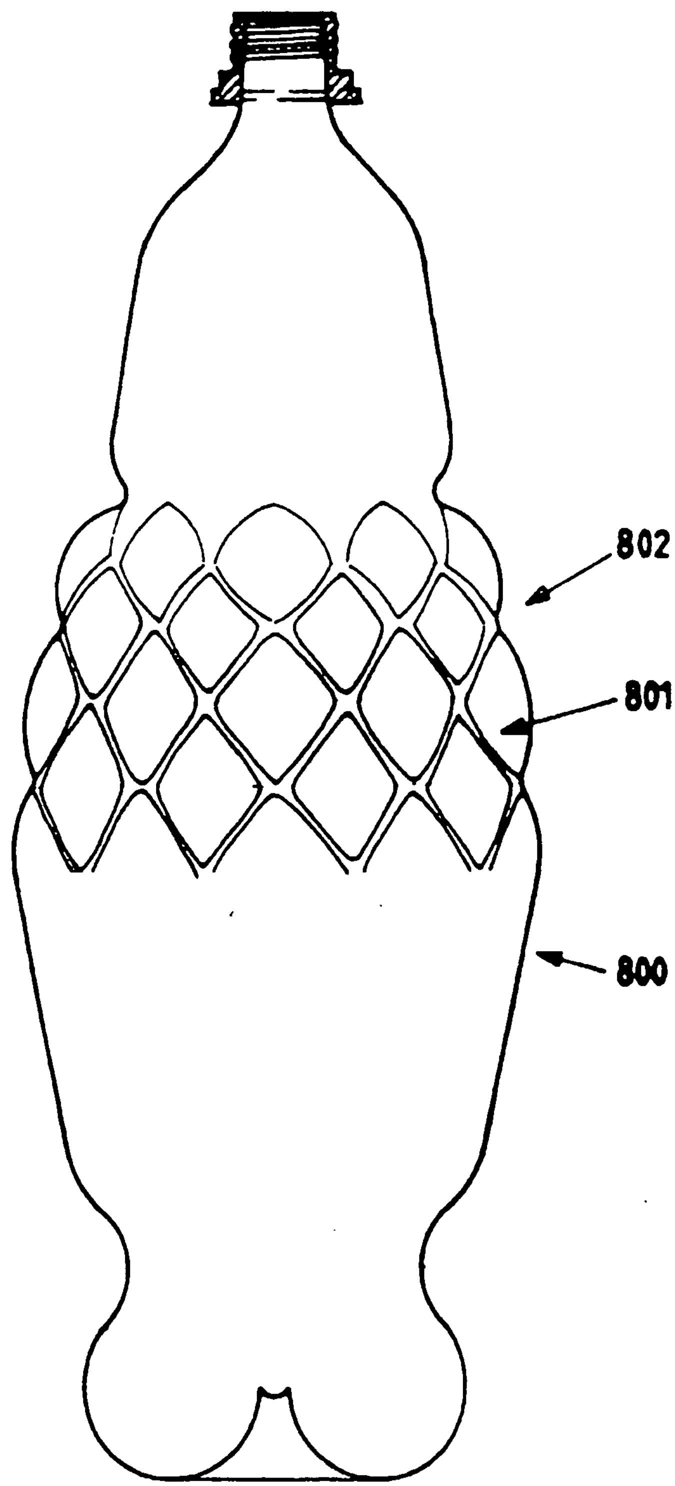


FIG.16.

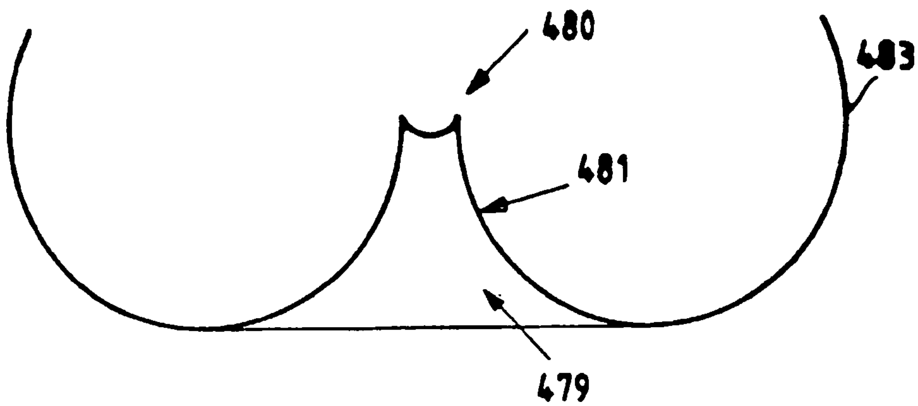


FIG.17.

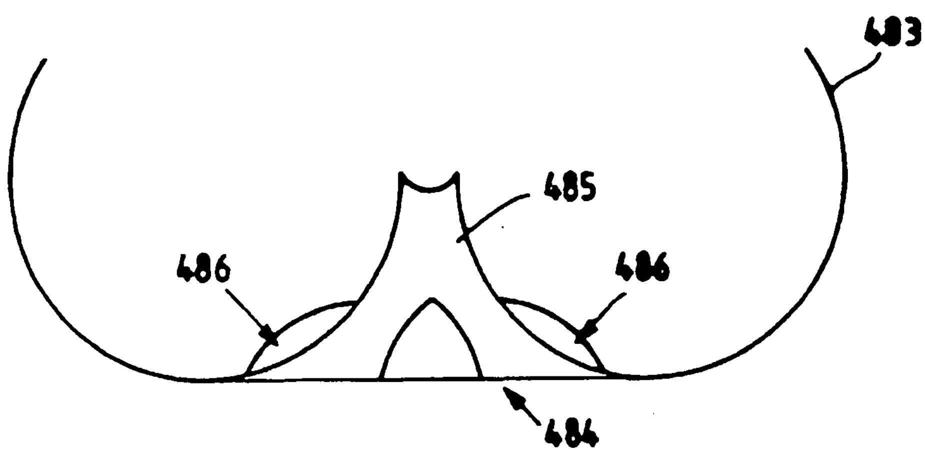


FIG.18.

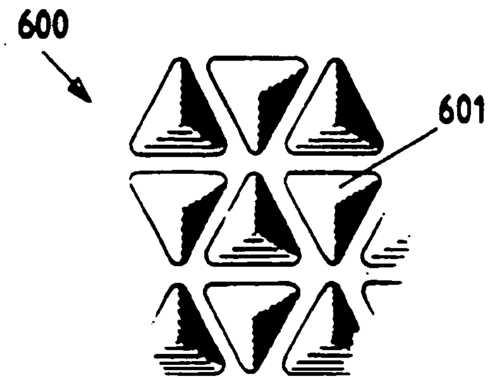


FIG.19 a

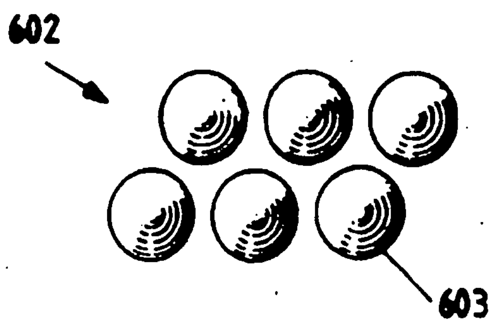


FIG.19 b

FIG.20.